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# Investing in the biology revolution

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Technology has transformed our world — and our investment opportunities — over the past decade. So, what comes next? What will be the next disruptor to bring dramatic change to our everyday lives and great potential to our investment portfolios? In our view, “synbio” is a top candidate. We believe synbio — synthetic biology — could rival trends like e-commerce, cloud computing, and electric vehicles as the next big revolution. From mRNA Covid-19 vaccines to mushroom yoga mats to Impossible Burgers to lab-grown seafood, we’re already seeing tangible signs of the enormous potential in synbio.

## Today, we all know a lot more about biology

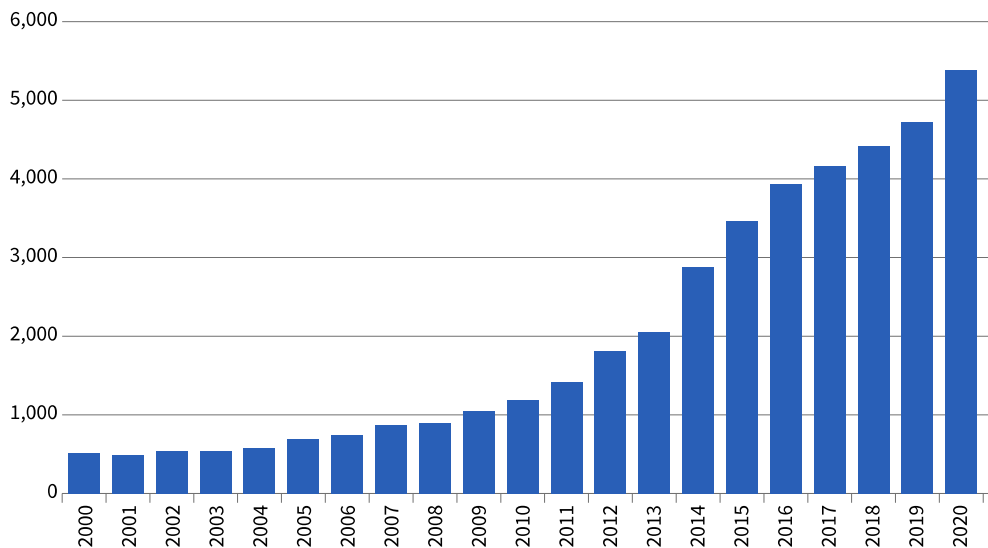
Now that we are well into the second year of the Covid-19 pandemic, the importance of biology has become much more obvious. The virus itself and the health care industry’s response, most notably the development of vaccines, have highlighted the power in the process of engineering cells and proteins. Historically esoteric concepts like PCR and mRNA are now part of our daily conversations and no longer the exclusive domain of scientists.

## Synbio: Biology innovation beyond health care

What is less obvious — and very exciting for investors — is the potential for biology outside of health care. Synbio is used to design and grow products of superior quality and, more important, to create products that are significantly more sustainable. Synbio has the potential to replace many of today’s chemical- and petroleum-based manufacturing processes, so it offers compelling environmental benefits. In some cases, synbio involves designing a completely new custom DNA sequence and inserting it into a cell. In other cases, adjustments are made to existing microbes. And since DNA code is just another form of data, we believe it has the potential to benefit from an improvement curve similar to the one that has been demonstrated in computing. While this sounds like science fiction, we’ve had the ability to program cells — a process known as DNA synthesis — for quite a while.

## Interest in “synbio” is growing rapidly

Number of academic citations of synthetic biology



Source: National Institutes of Health.

One early and fun example of synbio can be found with athletic apparel retailer Lululemon Athletica. The company has partnered with scientists at Bolt Threads to develop innovative and sustainable bags and yoga mats made from the root structure of mushrooms. Lululemon is also experimenting with synbio-derived fabrics. Another example is Impossible Foods, a private company that develops plant-based substitutes for meat products. Its Impossible Burger is made with a protein produced by genetically modified soy grown in bioreactors like the ones that Sartorius, a pharmaceutical and laboratory equipment supplier, sells to its customers to create biological drugs.

Other companies are developing biological cement, biological chemicals, and modified row crops that can pull nitrogen out of the air, eliminating the need for applied fertilizer.

Over time, we believe synbio could impact nearly every part of the physical goods economy. It can create new and exciting products and solve challenging sustainability problems. The clothing industry, for example, uses hydrocarbons for 60% of its materials. What if synbio company Genomatica can create bio-based nylon? This intersection of technology and biology can be a powerful economic driver for many industries and could become the defining source of innovation and disruption in the coming decades.

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## The investment opportunity

From an investing standpoint, we see opportunities within three broad categories.

**Technology enablers.** We view these companies as pick-and-shovel providers for synbio. They are companies that sell equipment and materials necessary to analyze, design, and build biological materials such as DNA, RNA, and microbes. For example, Twist Bioscience sells oligos, the building blocks of synthetic DNA. Thermo Fisher Scientific and Danaher sell bioreactors and filtration used to produce biological materials.

**Synbio companies.** These are businesses whose main focus is building biological-based products. These are typically earlier-stage and fast-growth companies like Ginkgo Bioworks, which has created a horizontal platform to help companies design their own bio-products. Another example is Amyris, which produces biologic-based skin care products. We also include traditional biotech companies in this category.

**Early adopters.** These are companies whose core business has not traditionally focused on biology. In our view, these established companies are taking advantage of the potential disruption of synbio. Examples include clothing companies like Lululemon and food companies such as Nomad Foods, which is partnering to offer products like cell-cultured seafood, where cells are extracted from fish in order to reproduce them in a lab setting.

We believe synbio will become a major wave of innovation and one of the most exciting areas of the market in the coming years. It could help drive new areas of growth, and many companies can capitalize on this technology. While we are still in the very early innings of this revolution, we believe synbio will grow into a massive market and a potential multi-trillion-dollar opportunity.

Holdings in Putnam Research Fund as of 9/30/21: Danaher (0.85% of fund assets); Lululemon Athletica (0.07%); and Thermo Fisher Scientific (0.94%). Amyris, Genomatica, Ginkgo Bioworks, Nomad Foods, Sartorius, and Twist Bioscience were not fund holdings.

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